US-PAT-NO: **5490300**

DOCUMENT-IDENTIFIER: US 5490300 A

TITLE: Air amplifier web cleaning system

---------- KWIC ---------

An air amplifier utilizing the **coanda** effect is disposed adjacent to a web of material to be cleaned. A relatively small volume of compressed air is driven from a slot onto a curved wall surface. The "**coanda** effect" causes that compressed air to adhere to the wall, and causes a suction creating a relatively high-volume air flow upstream from the slot to be drawn along with the small volume of air adhering to the wall. The high-volume amplified flow of air is drawn along the surface of a web of material to be cleaned to entrain impurities from the web of material to be cleaned. A vacuum source is mounted adjacent to the end of the wall such that impurities are drawn into the vacuum source and removed from the area. In addition, ionized particles are directed into the relatively high-volume air flow to increase the cleaning efficiency of the system. The present invention provides a high efficiency web cleaning system that need not be mounted as close to the web as prior systems. In this way, it is practical for use in many applications that have not been adaptable to the prior art.

The present invention preferably incorporates a so-called "air-knife" or "air amplifier" of the sort which drives a relatively small volume of air along a wall surface, such that the air adheres to that wall surface. This phenomenon

is called the "coanda" effect. This small volume of air creates suction in the adjacent air which pulls in very high volumes of air along with the relatively small volume of air. Amplifications of air volumes on the order of 30 to 1 may be achieved with such air amplifiers.

Such amplifiers have been utilized for blowing off parts to be cleaned. The structure necessary to achieve the coanda effect is well known, and forms no portion of this invention. Essentially, a thin, elongated slot or nozzle is formed in a housing member adjacent to a wall face that curves around a bend. Typically, this bend can be up to 90 degrees. A relatively high-velocity, relatively low-volume air flow is driven along that curved wall face from the slot. By maintaining the slot to a desired relatively thin opening, and by controlling the contour of the wall face, it is possible to ensure that the relatively high-velocity, low-volume air adheres to the wall face and is driven around the curve of the wall face. This, in turn, creates a suction adjacent to the slot which entrains a relatively high quantity of air. The structure of the amplifier itself is known, and is commonly available on the market. One such amplifier is available under the trade name Exair Air Knife from Exair Corporation of Cincinnati, OH. Workers of ordinary skill in the art would be aware of the dimensions and parameters of operation necessary to create the coanda effect and resulting air amplification results.

A web cleaning system 20 is illustrated in FIG. 1 incorporating a coanda effect air amplifier 22, which creates a flow of cleaning air across a web. The cleaning air and entrained impurities are drawn into a vacuum tube 23, through an opening or aperture 24. The vacuum tube 23 draws the air and entrained

impurities from the web into aperture 24, removing them from the area of the
web.

As shown in FIG. 2, the air amplifier 22 includes a slot 43 through which is
driven the relatively high-velocity compressed air which adheres to a curved
wall face 42. As is known in the art, by controlling the surface of wall 42,
and the thickness of slot 43, one ensures that the air flow 32 continues to
adhere to wall 42. As is also known, the **coanda** effect creates a suction
drawing a very high quantity of air 34 from a location upstream of slot 43. By
properly positioning slot 43 such that it initially moves towards web 30, but
then curves and adheres to wall face 42 away from wall 30, one creates an air
flow 34 along the face of web 30, which is then drawn into aperture 24,
removing air and impurities from the web 30.

As stated above, in a method of cleaning a web of material according to the
present invention, an amplifier capable of creating a **coanda** effect air flow is
positioned such that a small volume air flow initially moves toward a web of
material to be cleaned, but then flows away from the web of material creating a
relatively high-volume flow of cleaning air along the face of the web. The air
is then driven out of the slot and along the wall, creating a relatively
high-volume flow of air along the surface of the web of material to be cleaned.
In one application, positively and negatively charged ions may be directed into
the high-volume flow of air to further increase the efficiency of impurity
removal from the web.

3. A system as recited in claim 2, wherein said amplifying body is a
coanda-type air amplifier having a slot providing said relatively small volume

of air onto a wall surface configured such that the air flow adheres to the
wall, creating the high-volume flow upstream from said slot.

5. A system as recited in claim 1, wherein said amplifying body is a
coanda-type air amplifier having a slot providing said relatively small volume
of air onto a wall surface configured such that the air flow adheres to the
wall, creating the high-volume flow upstream from said slot.